



military recreation



NAVMC 2786



Auto Hobbyshop Guide

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HEADQUARTERS UNITED STATES MARINE CORPS
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FOREWORD

1. PURPOSE

NAVMC 2786, Auto Hobbyshop Guide, is designed to assist auto hobbyshop managers in administering and operating their programs. It is informative in nature and provides guidelines and information on program management and operations.

2. INFORMATION

a. This NAVMC should be utilized by MWR staffs and managers of auto hobbyshops to assist in their planning, management and operations of auto hobbyshop facilities and programs.

b. For requisitioning instructions see the current edition of MCO P5600.31, Marine Corps Publications and Printing Regulations.

3. CERTIFICATION

Reviewed and approved this date.

A handwritten signature in black ink, appearing to read "J. R. Joy", is written over a circular stamp.

J. R. JOY

Director, Morale, Welfare and
Recreation Support Activity

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AUTO HOBBYSHOP GUIDE

INTRODUCTION

Of all the activities offered by MWR, few are as heavily used by enlisted Marines as the auto hobbyshop. The high cost of repair work on cars makes auto hobbyshops important in an economic sense. The car is usually the one major possession enlisted Marines have and take pride in. Their car is also important to them as a source of independence, as with most other Americans, allowing them to go places and do things without having to depend on someone else for transportation.

Basically, cars are important to all Marines and, as a result, they should be important to someone who provides service to Marines--You.

AUTO HOBBYSHOP GUIDE

CHAPTER 1

PLANNING

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CHAPTER 1

PLANNING

1000. PLANNING

1. Planning is essential to the success of any MWR operation. The planning process attempts to organize the future, what has to be accomplished, and when it has to be done. Since most management problems happen on a day-to-day basis, most managers tend to focus only on the present. Long-range planning to some is next week.

2. An effective planning process is to our best advantage. The benefits realized are as follows:

a. Established sense of direction.

b. Coordinated effort and maximum use of resources.

c. Increased foresight in terms of meeting future activity needs and operation requirements, thereby reducing crisis management.

3. Most of us have prepared a budget at one time or another. A budget is a plan. The same type of thinking that goes into a budget is used in other planning. Unfortunately, very little planning is done for the programs that we run. The same benefits that apply to financial planning apply to all types of planning.

1001. HOW TO PLAN

1. There are three basic steps in planning.

a. Setting the Goal. The goal is the statement which gives the direction in which an activity is going, and is not usually measurable. Goals are usually set by each level within an organization: the MWR level, the activity level, and the individual level. Activity goals are normally set by the MWR Director and should be compatible with goals at other levels.

b. Stating the Objective. An objective is a specific action you take to reach a certain goal. There can be more than one objective to be accomplished to reach it. Whenever possible, an objective must be measurable. The objective should be challenging, but realistically attainable.

c. Writing the Action Plan. The action plan is basically a document that lays out the necessary steps to achieve an objective. It should include all logical steps, who will do them, when they will be done, and how they will be done. Appendix A is an example of an action plan. For more detailed information on planning, see NAVMC 2777, Recreation Manager's Planning and Marketing Guide.

1002. FOLLOW UP. The best written objectives and action plans in the world do no good unless someone follows up on the implementation of the plan. The reviewing process is important. Once a plan has started, someone must review action-step-completion dates and evaluate the progress toward the objective. This continuing process requires that as progress is or is not made, the plan must be evaluated to determine whether or not the given objectives can be met or if they have to be modified. For example, if you are going to use twice as many supplies as planned then you have to plan for additional supplies.

1003. PLANNING FOR BUREAUCRATS

1. Have you ever said to yourself, "If I only had a new brake lathe (or whatever), the program would be so much better." Well, we seldom get things just by wishing for them or by telling our supervisor that it would be nice to have. This is another area in which planning comes in handy. Supervisors are generally all alike in some areas. They control a limited amount of money and are trying to make it go as far as possible. You must justify your needs.

2. If you want to get something, you must have a plan on how to get it. You must sit down and write out the reasons why something would be useful. Also you might write down what would happen if you don't get something. Which request would sound better to you if you were in charge of buying new equipment?

"I want to get a new brake lathe because the shop needs one."

or

"If a brake lathe was purchased, the shop operation would be improved in the following ways:

a. A new and frequently requested service would be provided to patrons.

b. The lathe would increase shop patronage by 5 percent a year.

c. The lathe could be used for class instruction to teach a new area of auto repairs.

d. The brake lathe could pay for itself in 2 years through fees generated and still provide a substantial savings to the patron.

e. It could continue to provide revenue that would help buy other shop equipment."

3. Part of planning is having good data to back up your estimates. If you take the time to plan properly and have information to back up what you say, you will be amazed at the success you will have.

4. The principle of planning discussed here is important to most activities. If you are going to have a successful program, you must plan so that you will use your resources in the most efficient and effective manner.

5. The planning format in appendix A can assist you in starting basic automotive classes.

6. Suggested equipment to be included in a hobbyshop is at appendix B. While this is a generic list, equipment should be tailored to your operation.

7. A checklist for tool, facility safety, and job efficiency is located in appendix C.

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CHAPTER 2

OPERATIONS

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CHAPTER 2

OPERATIONS

2000. EQUIPMENT

1. You cannot work on cars without tools. One of the most important jobs for an auto hobbyshop manager is to equip the shop properly. You must select the tools that are appropriate for your program. Appendix B contains a list of suggested tools. The size and requirements of your program, as well as the availability of resources, are factors you will consider to determine the number and types of tools needed.
2. Most shops have a good selection of hand tools, but one of the more difficult decisions to make is what types of larger equipment should be purchased.
3. Various systems in new cars are getting more complicated and more difficult for the lay mechanic to work on, especially the engines. The advent of sophisticated engine computer systems and the numerous sensors to monitor engine functions are ending the days of "back-yard" mechanics doing a tune-up with a timing light and a dwell meter.
4. A major tune-up these days consists of mainly changing the plugs and checking the sensors. An individual can do very little in the way of engine adjustment because most of the primary and secondary electrical systems are computer controlled.
5. Modern engine analyzers are valuable tools. They can check the function of most or all of the engine operation systems; unfortunately, they are very expensive. A computer based, automatic test engine analyzer can range in price from \$10,000 to \$25,000. Buying one will require planning and justification. If you want to buy one with appropriated funds, the purchase must be made from Procurement Marine Corps (PMC) funds.
6. Inexpensive testers range in price from \$100 to \$1200. They can help in locating problems in the electronic systems by making use of the car's computer. This type of item may provide an inexpensive alternative to an engine analyzer. These little testers can help diagnose problems, but once diagnosed, repairs are not always easy. Some of these repairs require substantial training and more equipment. A set of service manuals is a must. More and more problems, especially with carburetors and emissions sensors, will require the owner to take the vehicle to the dealership.

7. Instead of concentrating entirely on the engine and its systems, you should consider offering other services such as wheel balancing, brake work, and front end alignments. New equipment is available which can do these jobs simply and relatively inexpensively. Also, the technology of the peripheral systems is still easily understood by most people.

8. Some points to remember when considering equipment purchases are:

a. Computer based engine analyzers are fast, but expensive. A similar engine analyzer with manual tests versus automatic ones can get the same results. A computer based analyzer would be more useful in a large shop that would expect high usage and would need more rapid service on each car.

b. Dynamic wheel balancers are no longer the giants with the 220 volt motors. Many dynamic balancers are now available which run on 110 volt current. Bubble balancers are not to be used with radial tires. If you have one, make sure your customers know this.

c. If considering a wheel alignment service, consider a wheel alignment lift versus a built-in rack. A lift is much more versatile and can be used for things other than wheel alignment.

d. Electric, above ground hoists should be combined with built-in hydraulic ones. Electric hoists have several advantages over inground hydraulic ones.

(1) Electric hoists can be moved.

(2) Certain types of work (exhaust system, drive shaft) are easier on the two-post electric hoists.

e. When equipping a shop with drills, chisels, ratchets, etc., consider equipping each stall with an air outlet from a centralized compressor system. Pneumatic tools are safer and generally more durable. They are also easier to repair if broken.

f. When you are buying hand tools, you should select a medium priced tool that has a lifetime guarantee. A cheap tool is usually just that--cheap. With the wear and tear they receive, the constant cost of replacing those tools, together with customer dissatisfaction, makes these types of tools a poor investment. Expensive tools, on the other hand, generally offer marginally better performance for the increased costs. One area in which they might be better would be high stress tools such as impact wrench sockets and puller sets. The added strength would add to the safety of the tool.

2001. TOOL CONTROL

1. Now that your shop is fully equipped, how do you make sure the tools do not disappear? This is where the importance of tool control comes in.

2. There are various methods that have been successful. They are as follows:

a. Each patron who checks into the shop is assigned a ring of tags with one number on them. For each tool borrowed, a tag is placed in the space from where the tool is removed. If a tool is missing, a glance can tell who has it.

b. Provide a basic set of tools to the patron checking in. All sets should be mounted on shadow boards so that all tools can be easily checked visually; also, all sets of tools should be identical to prevent confusion. This system has the advantage of not requiring the patron to continually come back and ask for tools. When the patron checks out, a quick inventory can be made of the set.

c. Paint the surfaces of all tools in the same color. This helps to control each set and makes sure the patron does not switch their tools with your government purchased tools.

d. Sign out each tool on a check in/out sheet. This is probably the most highly controlled means of issuing tools. It is also time consuming.

3. Any method can be used as long as it works. The ideal method would balance these factors:

- a. Service to the patron
- b. Security of the tools
- c. Convenience to shop staff

2002. LOST TOOLS. Tools are government property. If someone is negligent with tools, then they should pay for them. Reimbursement for tools should be made to the Custodian of the Recreation Fund or the Director of the Morale Administrative Support Division.

2003. TRAINING

1. A shop can have the finest tools, but they are useless unless someone knows how to use them. With the complexity of today's cars, a comprehensive training program is becoming a necessity.

2. Major automobile manufacturers have training programs through which dealer technicians are trained. Frequently, these courses are available to non-dealer people. Courses are available through the manufacturer's training centers in most major cities in the United States. Generally, writing the center and requesting enrollment is all that is necessary. Requests for these courses should be limited to managers and permanent personnel only. The general public would not be accepted. While it would not be practical to participate in all dealer technician courses, overview courses can be very helpful.

a. One of the best investments a manager can make is to buy a set of shop manuals from car manufacturers each year.

b. Another source of training would be through local colleges or technical schools. They often have good programs at competitive prices.

3. Training for automotive specialties is very important; however, it is not the only form of training managers should be concerned with. What if a patron loses a finger due to an accident, or someone passes out and stops breathing. Would you know what to do? Would anyone in the shop know what to do? First aid training and cardiopulmonary resuscitation (CPR) training are important for anyone who works in a patron service activity, especially a high risk area such as a hobbyshop. Base medical personnel can be a source of training, the local Red Cross, or a local college. The important thing is to get the training.

4. Some other areas that should be addressed in the employee training programs are as follows:

- a. Customer relations
- b. Safety
- c. Property/cash control
- d. Personnel information

5. We have been concentrating on the employee, now let's look at the patron. One of the best ways to improve business is to teach new patrons how to work on cars. Basic auto tune-up courses for men and women should be popular at most bases. Some other possible courses are as follows:

- a. "How to Do a Brake Job."
- b. "Auto Body Repair."

- c. "Installing a Car Stereo."
- d. "Engine Rebuilding."
- e. "Welding with Electric Arc and Acetylene."

6. The more people learn about automobiles, the more they are likely to use the shop. There are many ways to increase revenues without increasing prices.

7. The last point about training is that you should have a certification program for any patrons who are allowed to use dangerous tools. Record of these certifications should be kept on file or be kept by the patron as long as they are at a given command.

Note: Snap-on Tools conducts a free tool safety lecture for groups. You can contact your local dealer for details.

2004. DISPOSING OF JUNKED CARS AND ENGINES

1. Nothing looks worse than a yard full of decaying cars or a room full of scattered valve covers, crank shafts, and engine blocks. They are advertisements of failure. A clean shop is a sign of good management that keeps cars running.

2. Abandoned cars and engines are a continuing problem. Each shop should implement a program to dispose of abandoned cars or parts in a timely manner. No car should be left sitting in a storage lot for more than 30 days without some work being done. Junk cars not only take up valuable space, but are a safety hazard and an eyesore. Patrons should be informed that any equipment will be considered abandoned if not worked on within a set time limit. They should also be informed that abandoned equipment will be disposed of through appropriate channels.

2005. SHOP ENVIRONMENT

1. Auto shops should be clean, well-lighted, have attractive useful signs, and have a friendly informed staff. The way a shop appears affects how a person will perceive its operation. If someone sees a sloppy, dimly lighted shop, then they are likely to think that the operation is sloppy.

a. Cleanliness. There is no reason why an auto shop should be constantly covered with grease and oil. It not only looks bad, but is also a safety hazard. There are numerous floor and wall coverings that are grease and oil resistant and are easily cleaned. Tools should be kept free of dirt and grease,

and all working areas should be cleaned daily. All other equipment should be kept clean to ensure proper working order. Grease in a rifle barrel doesn't make the bullet go faster.

b. Lighting. All working areas should be lighted to the level of 50 to 70 foot candles. A poorly lighted area is hard on the eyes and unsafe. Fluorescent lighting is generally best from a cost and efficiency standpoint, but supplemental work lights are a must.

c. Signs. All signs in a shop should look professional. They should also be kept to a minimum. Hand lettered signs on notebook paper should only be used in emergencies. The quality of a sign reflects the quality of the shop. Signs should be neatly lettered in bright, easily readable colors; not everything has to be in scarlet and gold. The language used in signs should be simple but informative. The language should also be positive. Which sounds better to you?

"WALKING ON THE GRASS IS STRICTLY PROHIBITED"

or

"PLEASE USE THE SIDEWALK"

2006. CUSTOMER RELATIONS

1. If there were no patrons coming to your shop, you and your staff would not have a job. Many people forget this. When someone comes into the shop, that person should be met with a smile and, "May I help you?" not, "Whadda ya want?" People use recreation activities to relax, and they should get courteous treatment. They don't want to be hassled. ~~Even~~ when someone is angry about something, your professional responsibility is to be as polite and fair as possible. If you can't help patrons, then you should refer them to someone who can.

2. If patrons break shop rules, you should not descend on them like the "Grim Reaper," but politely inform them of the mistake. Most people don't break rules intentionally. We want patrons to enjoy themselves and come back. If they do come back, they may bring a friend next time.

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CHAPTER 3

RESALE

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CHAPTER 3

RESALE

3000. MERCHANDISE

1. The most important questions that we need to ask ourselves when talking about resale merchandise are: "What items should I carry?" and "How many of them should I stock?" These questions sound easy but are actually very difficult to answer. One constraint, which should affect the answers to these questions, is that the type and number of items carried in any resale activity should be the minimum necessary to adequately service patrons. Far too many people get into resale operations and never have the slightest idea of what they are doing. As a result, many operations acquire too much inventory. This is the main problem with most resale operations. How many people really need spark plugs to fit a '37 Plymouth?

2. Whenever possible, items stocked in a resale operation should not be specific items for one type of car. For example, the following items are not specific to one make or model car:

- a. Oil
- b. Wheel bearing grease
- c. Engine degreaser
- d. Antifreeze
- e. Windshield washer antifreeze
- f. Radiator hose clamps
- g. Heater hose
- h. Fan belts

3. Other items, more specific to certain makes, that could be carried, are as follows:

- a. Spark plugs
- b. Fuel filters
- c. PCV valves

4. Inventories should be kept to a minimum. Frequently inventories are the largest single item in current assets. Money invested in inventory cannot be used for anything else. Always make sure that you are getting an adequate return on the money invested in resale merchandise.

5. Resale operations should generally begin small and then expand only as the business warrants. Remember--the more stock you have, the more you have to inventory. Bigger is not necessarily better.

6. As an adjunct to providing a resale service, keep information available on local commercial parts stores that would be able to provide a more thorough selection of parts than an auto hobbyshop.

3001. PRICING

1. As far as setting the price for any given item, markup is established in writing by the MWR Director, but you should be familiar with the process. There are many factors involved in pricing an item based on the percentage of profit that must be generated. There are two basic ways of doing this--the markup and the margin methods.

a. The markup method is taking the basic cost of an item (including other costs) and adding a set percentage to it. For example:

Cost of Oil: Basic cost \$.94 per quart

Handling cost .03 per quart

Shipping cost .03 per quart

Cost of goods \$1.00 per quart

Price of Oil = Cost of goods \$1.00 + 20% = \$1.20 selling price.

This method is fine except when you want to discount the item for a sale. If you mark down the item 20 percent, then the price will be \$.96 -- less than the cost of the item. Here's why.

$$\$1.20 \times .20 (20\%) = \$.24$$

$$\$1.20 - .24 = \$.96$$

b. A better method is to use the profit margin method. Here's an example: Cost of goods \$1.00

Profit Margin 20 percent

$$(.80 = 1.00 - .20)$$

Price of Oil = $1.500 / .80 = \$1.25$ Sell Cost

This way if you give a 20 percent discount, the selling price will be \$1.00, or the cost to you of the item.

$$\begin{aligned} \$1.25 \times .20(20\%) &= \$.25 \\ \$1.25 - .25 &= \$1.00 \end{aligned}$$

3002. INVENTORY LEVEL CONTROL

1. Three main areas are of concern to you in controlling inventory levels. They are as follows:

- a. Inventory turnover
- b. Reorder points
- c. Economic order quantity

2. Explanations of these concerns are:

a. Inventory Turnover. Inventory turnover is the number of times each year that you sell your average inventory level. Let's say that your inventory has a value of \$2,500 at any given time. To find the inventory turnover you would divide this figure into total cost of goods sold.

$$\begin{aligned} \text{Inventory turnover} &= \frac{\text{Annual cost of goods sold}}{\text{Average Inventory}} \\ &= \frac{\$10,000}{2,500} \\ &= 4 \text{ times} \end{aligned}$$

In this case the inventory turnover is four times. Inventory turnover is one way to tell if your average inventory is too large. A large auto parts company sets a minimum inventory turnover level of 3.5 times. They like to see it higher than that. If you are only turning over your inventory 1.5 or 2 times a year, there is a chance that your average stock level is too high. Of course, these figures are only a management guide, not a hard and fast rule.

Some areas have traditionally high turnover and others have a low turnover just as some businesses have different turnovers. For example, a grocery store may turn over their inventory once a week while a jewelry store may only turn over their inventory once every 9 or 10 months. It would be a good idea to contact local parts stores to see what their turnover rates are.

b. Reorder Points. How do you know when to reorder an item? When you run out? When you are down to one? Determining reorder points for items in stock will take the guess work out of reordering. Basically, a reorder point is the stock level at which you must reorder an item to avoid being out of stock. You do this by multiplying the average daily usage by the lead time.

Average Daily Usage - Average number of units sold per day

$$\frac{\# \text{ of units sold annually}}{\# \text{ of days open annually}} = \text{average daily usage}$$

Let's say

$$\begin{aligned} \# \text{ of units sold annually} &= 1,000 \\ \# \text{ of days open annually} &= 250 \end{aligned}$$

or

$$\frac{1000}{250} \quad \text{average daily usage} = 4 \text{ per day}$$

(1) Lead Time. The number of days it takes to receive an order after requested.

Let's say lead time equals 10 days.

(2) Determining Reorder Point. When your stock reaches 40 units you should reorder.

$$\begin{aligned} \text{Lead time} \times \text{Average Daily Usage} \\ 10 \text{ days} \times 4 \text{ units/day} &= 40 \text{ units} \end{aligned}$$

(3) An item being out of stock can cause unhappy patrons. If being out of stock is something you wish to avoid at all cost, then you should add a safety stock to your reorder point.

(4) Safety Stock. Extra stock held as protection against being out of stock. Suppose the longest lead time that you have ever experienced was 12.5 days.

In this case, you would add a 2.5 day safety stock to prevent any chance of being out of stock.

Longest lead time - 12.5 days
Normal lead time - 10 days

$$\begin{aligned} 12.5 - 10 &= 2.5 \text{ day safety stock margin} \\ 2.5 \text{ days (safety margin)} \times 4 \text{ units/day (daily usage)} &= 10 \\ \text{units (safety stock)} \end{aligned}$$

Your new reorder point including safety stock would be 50 units.

40 units (reorder point) + 10 units (safety stock) = 50 units

c. Economic Order Quantity (EOQ). Once you reorder something, how much should you order? 50 units? 500 units? The EOQ indicates the most cost effective level of an order. By definition, the EOQ is the order quantity which minimizes the total annual cost of ordering and carrying inventory.

(1) Ordering Costs. Costs related to getting an item into inventory (dollar per order). Some examples are as follows:

- (a) Requisition costs (salaries, paper, gas)
- (b) Purchasing costs (salaries, telephone, clerical)
- (c) Receiving costs (salaries, gas, clerical)

(2) Carrying Costs. Costs related to holding an item in inventory (percentage of average inventory). Some examples are as follows:

- (a) Interest lost on money invested in inventory
- (b) Obsolescence/deterioration of stock
- (c) Operation cost (record keeping, inventory, security, insurance)

(3) Determining the EOQ. There are two basic methods for determining the EOQ, the tabular method and the formula method. Examples of the two methods, using the following variables, are provided below.

VARIABLES TO BE USED IN BELOW EXAMPLES

Number of Orders per year = (N)

Total Dollar Value (DV) of item used each year = \$10,000 = DV
(1,000 units x \$10)

Carrying Cost (CC) (percentage of average inventory) = 15% = CC

Ordering Cost (OC) (dollars per order) = \$2

Economic Order Quantity (EOQ) = Number of units annually divided by N

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EXAMPLE OF TABULAR METHOD

(1)		Orders Per Year	1	2	4	6	12
(2)	\$10,000 ÷ Orders/Year	Dollars Per Order	\$10,000	5,000	2,500	1,666	833
(3)	DV ÷ 2	Average Inventory	\$ 5,000	2,500	1,250	833	417
(4)	Average In- ventory X 15¢	Carrying Cost	\$ 750	375	188	125	63
(5)	Orders/Year x \$20	Ordering Cost	\$ 20	40	80	120	240
(6)	Carrying Cost + Ordering Cost	Total Cost/Year	\$ 770	415	268	245	303

N = 6

EOQ = 6 Orders of 167 (1000/6) Items Each

EXAMPLE OF FORMULA METHOD

$$N = \sqrt{\frac{DV \times CC}{2 \times OC}} = \sqrt{\frac{\$10,000 \times .15}{2 \times 20}} = \sqrt{\frac{1,500}{40}}$$

$$= \sqrt{37.5} = 6 \text{ (Rounded) Orders of 167 Items Each}$$

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CHAPTER 4

SAFETY AND HEALTH WARNINGS

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CHAPTER 4

SAFETY AND HEALTH WARNINGS

4000. SAFETY

The purpose of this chapter is to remind you of the possible safety and health hazards that may occur when oil products and equipment are handled improperly. It also outlines the precautionary steps that should always be taken to minimize the risk of injury or illness while using products that are part of our working lives.

4001. PRECAUTIONARY INFORMATION

1. Fire Prevention

a. Keep Gasoline Away from Heat, Sparks, and Flames

- Maintain a list of hazardous chemicals, how much and where they are located in the facility.
- Gasoline is extremely flammable. Gasoline vapors may explode if they come in contact with a source of ignition.
- Do not smoke when handling gasoline or volatile liquids.
- Turn off your car engine while filling the gas tank.
- Put gasoline into a small engine (like a lawn mower) only when the engine and attachments are cool.

b. Use of Gasoline

- Use only as a motor fuel. Do not use gasoline for any other purpose.
- Do not mix even small amounts with kerosene or fuel oil.
- Do not use in kerosene heaters or lamps.

c. Fire Fighting Procedures:

- Evacuate immediate area at direction of fire department.
- For fires in enclosed areas, fire fighters must use self-contained breathing apparatus.

- Cool storage containers exposed to heat with water spray.
- Prevent fire water runoff from entering streams or drinking water supply.
- Use CO2, foam, dry chemical, or water fog to control gasoline fires.
- If equipment malfunctions, turn off power immediately and call the service agency which maintains the warranty. Do not activate the equipment until it has been serviced and approved by a certified repairman. If fire occurs use a CO2 or dry chemical system to extinguish the fire.

d. Storage

- Store only in approved containers that are properly and clearly labeled. Never store gasoline in glass or unapproved plastic containers.
- All fluids and containers must be labeled to identify their contents.
- Do not store or use products near a furnace, hot water heater, or anything with a pilot light. Store only in a well-ventilated area.
- Drums must be grounded, bonded, and equipped with self-closing valves, pressure vacuum bungs, and flame arresters.
- Store drums away from all ignition sources in a cool area equipped with an automatic sprinkling system. Outside or detached storage is preferred.

4002. DRAINING FLUIDS

1. Never Siphon or Drain Gasoline from Vehicle Tanks

Because of the danger of fire, as well as environmental and health concerns, gasoline, or gasoline/diesel fuel mixtures, oil, should never be drained or siphoned from a vehicle's tank. If a mixture occurs, or if the wrong product is put into a vehicle's tank, have the vehicle towed to an authorized facility which is equipped to do this type of work.

2. Incidental Draining of Gasoline

During vehicle repair work, it is sometimes necessary to disconnect a fuel line, carburetor, filter, fuel pump, or other

piece of equipment, which results in a small release of gasoline. In such instances, work should be done outdoors, or in a well ventilated area, away from sources of ignition such as flames, heaters, electrical appliance, sparks, cigarettes, etc. The product is to be drained into an approved container.

4003. STORING OF GASOLINE

1. Storage

a. To avoid sparking conditions, ground and bond all transfer and storage equipment.

b. Drums must be equipped with self-closing valves, pressure vacuum bungs, and flame arresters.

c. Store gasoline away from all ignition sources in a cool area approved by the Fire Marshal.

2. Portable Safety Cans

a. The most common piece of equipment for handling small quantities of flammable liquid is the portable safety can, ranging in size from one pint (0.5 liter) to five gallons (19 liters). Safety cans are made in numerous styles with dispensing valves, pouring spouts, or dispensing hoses.

b. Only containers that are listed or labeled by a nationally recognized testing laboratory are acceptable for handling gasoline.

c. Containers must be provided with an approved label, as required by Federal/State regulations. Stored materials must be labeled "Extreme Flammable Vapor Harmful."

3. Disposal of Clean Up Materials

a. Sawdust, rags, and other solid wastes that have been soaked with gasoline should be placed in approved disposal containers made of metal and equipped with self-closing covers.

b. Disposal containers should be clearly labeled as to the type of waste they are intended to receive.

c. Contents must be disposed of by an approved waste disposal agency in accordance with all applicable laws and regulations.

4004. DISPOSAL OF PETROLEUM PRODUCTS

Do Not Pour Any Product Down Sewers, Drains, Toilets, Sinks, Etc.

1. Laws and ordinances strictly prohibit pouring flammable and combustible liquids into sinks or floor drains that connect with sanitary or storm sewer facilities.
2. Approved containers should be used for waste flammable liquid disposal, and should be emptied periodically.
3. Waste liquids should be disposed of by any of the following methods:
 - a. Burning in an approved solvent burner.
 - b. Delivered to a waste-liquids collection agency.
 - c. Local fire departments may accept waste gasoline for use in fire training.

4005. EQUIPMENT USAGE

All equipment used in an auto hobbyshop must be maintained according to the manufacturer's guidelines and must be operated within its use parameters. Review all manuals with staff and potential users of equipment.

4006. HEALTH HAZARDS

1. The petroleum industry is presently conducting studies to determine possible effects of gasoline vapors on human health. As far as scientists now know, low-level or infrequent exposure to gasoline vapors is unlikely to be associated with cancer or other serious diseases in humans.

2. Do Not Put Oil Products In Your Mouth - Petroleum Can Be Harmful or Fatal If Swallowed.

- Never siphon gasoline by mouth.

3. Avoid Prolonged Breathing of Vapors

- Use gasoline or solvents only in an area that gets plenty of fresh air.

- Do not use gasoline indoors.
- Keep your face away from container opening.
- Do not overfill reservoir. As liquids heat up they

expand; leave room for expansion. Make sure the caps are put back on.

4007. TRAINING EMPLOYEES IN SAFETY

Safe practices by employees who handle flammable liquids are essential in the prevention of fire and explosion. Before working in jobs that require the use of flammable liquids, employees should be instructed in the characteristics, hazards, and methods of protection and control. Managers should check to insure that safe practices are being followed.

1. Training Programs

Employees should be trained in the basic safety practices contained in this guide including:

- a. Store gasoline only in approved labeled containers. Containers should be in good condition and closed when not in use.
- b. Never smoke, use open flames, or create sparks where there is a possibility of igniting flammable/combustible liquid vapors.
- c. Clean up liquid spills immediately; dispose of clean-up rags into proper containers; use only approved material to absorb spills.
- d. Check bonding and grounding connections for electrical continuity.
- e. Do not drain/siphon gasoline from tanks.
- f. Do not dispose of flammable liquids that are hazardous and must be handled with particular care.
- g. A safety checklist is provided at appendix C.

4008. HEALTH AND EQUIPMENT WARNINGS

Prevention of personal injury is an individual responsibility that can only be achieved if safe work procedures are followed. Unsafe shop conditions should be reported to the activity manager and corrected immediately. Records show that most accidental personal injuries result from:

1. Using hand tools or equipment improperly.
2. Using ladders improperly.

3. Falling on slippery or uneven walking surfaces.
4. Tripping on tools and equipment.
5. Using improper working positions.
6. Lifting or carrying incorrectly.
7. Not wearing eye protection or not using other personal protective equipment where required.
8. Not following proper work procedures.
9. Receiving burns from automotive cooling systems.
10. Not taking proper precautions to avoid hazards.

4009. EMERGENCY TELEPHONE NUMBERS

Emergency telephone numbers should be prominently posted near your telephone. Be sure to include your home telephone number and the numbers of the fire department, police department, and ambulance service. Be sure employees know where these numbers are posted and are familiar with the procedure for calling emergency services.

4010. HOUSEKEEPING

1. General appearance is important to successful and safe operation. The premises should be kept clean and attractive. Cracked windows or other damaged glass should be replaced promptly to avoid injuries.
2. Empty oil cans and battery solution containers should be kept in tightly covered receptacles.
3. Paint-soaked, greasy, or dirty rags should be stored in a container. Rags that have no further use should be disposed of in an outside trash container at the end of each work day.
4. When not in use, paint cans should be tightly covered and stored in a well ventilated, moderately cool area, away from any source of ignition.
5. Floors of the craft shop should be washed frequently to keep them free from grease, oil, and dirt to prevent slips and falls. Only detergent powders or nonflammable cleaning agents, specially formulated to remove grease and oil, should be used.

6. **Caution:** Never use gasoline or kerosene as a cleaning agent. The areas to be washed should be blocked off to prevent injuries caused by slipping. Floor drain sumps should be checked frequently, and accumulations of grease and sediment should be removed to prevent materials from flowing into the sewer.

7. Merchandise should be stored in areas where it will not obstruct foot or vehicle traffic.

4011. EXITS

All exit doors (except overhead garage doors) should swing out, opening in the direction of exit travel.

4012. LIFTING

1. The following procedures are recommended for safe lifting:

- a. Be certain of secure footing and grip.
- b. Keep the back straight and bend the knees: use the leg muscles to do the lifting.
- c. Hold the load close to the body.
- d. Avoid twisting or turning the body while lifting.

To set an object down, follow the same precautions as for lifting. Avoid lifting heavy objects, such as cases of motor oil, above waist level. If necessary to lift heavy or bulky objects, get help.

4013. PROTECTIVE CLOTHING

Personnel should be encouraged to wear personal protective clothing as needed at their facility. Recommended types of protective clothing and possible applications include:

1. Safety shoes with oil-resistant soles for general use around the shop.
2. Safety goggles wherever liquids or solids might splash, fall, or blow into the eyes or while handling corrosive liquids; i.e., battery acid.
3. Impervious aprons for handling battery acid.
4. Safety glasses or face shield wherever solids might get accidentally into the eye, for example during wire buffing or while working under vehicles or using grinders.

5. Impervious gloves for handling acids or caustic solutions.

6. Regular gloves for handling sharp objects.

4014. SKIN PROTECTION

Clothing that is soaked with gasoline or oil should be removed immediately, but only in an area or room with good ventilation and no source of ignition. The skin that was exposed should be washed thoroughly.

Alcohol-type antifreeze solution contains methanol (methyl alcohol), commonly known as work alcohol. Methanol is a poison and must not be taken internally since it may cause serious illness, blindness, or death. Methanol has a defatting effect on the skin and may cause severe dermatitis. It should be washed off immediately. In most cases, skin oil can be restored by using a hand cream.

Should your skin contact battery acid, brake fluid, or other caustic solutions, the contacted area should be flushed with water for at least five minutes. If the liquid contacts your eye, flush the eye for at least 15 minutes with lukewarm water. This water may be from a water hose at the shop. Contact your physician immediately.

4015. MEDICAL AND FIRST AID

At least one employee on each shift should be trained to render first aid. Completion of the American Red Cross basic first-aid course is adequate training. All employees should be given a basic understanding of first aid.

First aid supplies should be readily available, regularly inspected, and replenished as necessary.

4016. EMERGENCY SHUTDOWN SWITCHES

Employees should know the purpose and location of all emergency shutdown switches and be familiar with their operation. These switches should be identified and located no more than 100 feet away from the dispensers.

4017. PORTABLE FIRE EXTINGUISHERS

Portable fire extinguishers should be fully charged and in good working condition. Employees should be instructed in their proper use.

Be sure that the fire extinguishers are located in designated places so that they are readily accessible and immediately available in the event of fire. Obstacles should not block the fire extinguishers or hide them from view.

At least one fire extinguisher in the service area should have a minimum Underwriter's Laboratories classification of 10BC. (If you have an extinguisher purchased before June 1969 with a lesser classification, it will be acceptable if properly maintained.)

Caution: Carbon tetrachloride extinguishers are no longer permitted for use in fighting fires and should be discarded.

Fire extinguishers should be inspected visually at least monthly to ensure that they are in their designated places and to detect obvious physical damage, corrosion, or other impairments.

At least once every year, fire extinguishers should be thoroughly examined to ensure that they are in good operating condition. After extinguishers are examined and necessary repairs are made or maintenance is performed, attach a durable tag to each one showing the date the examination was performed and the initials (or signature) of the person who performed the inspection.

If an extinguisher is removed from the station to be recharged or repaired, it should be replaced with a spare extinguisher until the original extinguisher is returned.

Extinguishers must be hydrostatically pressure tested at 5-year or 12-year intervals, depending upon the type of extinguisher, by specially trained personnel. You should contact a local fire equipment distributor to determine the correct interval for your type of extinguisher.

4018. VENTILATION

Gasoline vapors are heavier than air and may find their way to an ignition source when released during certain repair operations. Adequate ventilation should be provided wherever gasoline vapors may be released to dissipate the vapors. If the work is performed inside an enclosed area, the doors and windows in the area should be opened.

Carbon monoxide, a colorless, tasteless, odorless gas, is a primary component of vehicle exhaust gases and can be extremely toxic or fatal when breathed in enclosed areas. Carbon monoxide may be piped from the vehicle's exhaust pipe to the outside through flexible hose.

4019. TOOLS

Do not use a tool in a job for which it was not intended. It may damage the tool or the equipment being serviced or result in an injury. Follow the manufacturer's recommendations for the maintenance and operation of any hand or power tool.

Portable electric tools should never be used by a person standing either in water or on a wet surface. Ordinary electric tools can be an ignition source and should, therefore, not be used where gasoline or other flammable vapors may be present.

Covered wash pans should be provided for the cleaning of tools and machine parts. Only kerosene or Stoddard solvent, having a flash point above 100 degrees F (38 degrees C), or an equally safe solvent should be used as a cleaning agent. Extreme care should be taken to ensure that traces of gasoline or other flammable liquids do not mix with cleaning agents. If agents become contaminated with gasoline or other flammable liquids, they should be replaced immediately because they lower the flashpoint of the liquid. Care should be taken to avoid skin contact with cleaning solvents.

4020. ELECTRICAL SYSTEMS

Due to the number and variety of electrical equipment and hand tools found in auto craft shops, the following items pertaining to electrical safety are included for reference:

1. All electrical installations and equipment should be installed and maintained in accordance with NFPA 70, National Electrical Code.

2. Each disconnecting means (circuit breaker or fuse) should be legible and marked to indicate its purpose unless located so that the purpose is evident.

3. Wall outlets and extension cords should have a three-wire ground system and be maintained in good condition.

4. Electrical hand tools, water coolers, and similar electrical equipment should be properly grounded or double insulated.

5. Electrical cords to appliances and equipment should be inspected periodically to insure that there are no cracks, breaks, or other deterioration in the insulation.

6. Plugs should be inspected periodically to insure soundness and the presence of ground lugs.

7. No conductor or electrical equipment should be located in wet or damp locations or exposed to excessive temperatures or other agents having a deteriorating effect without first contacting the manufacturer to determine the suitability of the location.

8. Electrical circuits should be protected by the proper size circuit breakers or fuses. A supply of replacement fuses should be on hand.

Caution: Never use a coin or piece of metal behind a fuse to restore electrical service. It can start a fire.

9. Since an overload circuit may be indicated by a blown fuse or the intermittent tripping of a circuit breaker, the cause of such a condition should be determined and any necessary corrective action taken immediately to prevent serious incidents.

10. Extension cords should be Underwriters' Laboratories (UL) listed, maintained in good condition, and free of splices. Extension cords should not be used where the fixed wiring can be provided.

11. Each electrical junction box should have a cover, which protects against accidental contact with energized conductors.

12. Sufficient access and working space should be provided and maintained around all electrical equipment to permit safe operation and maintenance.

The electrical power to all electrical tools, components, or fixtures undergoing repair should be disconnected. Recommend that the component's electrical circuit be tagged or locked out at the circuit panel.

4021. AIR COMPRESSORS

Rags and other combustible material should be kept away from the compressor. The manufacturer's instructions for the maintenance and operation of the compressor should be followed to ensure safe operation. Exposed moving parts on air compressors should be shielded by machine guards for personnel protection.

Air tanks should be protected by an adequate safety-relief valve or valves. These valves should be tested at regular intervals to ensure that they are in good operating condition.

4022. SPILLS AND DRAININGS

Should an appreciable quantity of fuel be spilled, it should be washed away with water or covered with absorbent material before anyone is permitted to start the vehicle's engine. All

attendants should be aware of the regulations relative to reporting and cleaning up petroleum product spills.

If it becomes necessary to disconnect or drain a fuel line or carburetor or to drain a fuel tank, such work must be done outdoors in a well ventilated area. When the quantity of fuel drained is sufficient to require storage, such storage must be in an approved, closed container.

4023. HOBBYSHOP SAFETY TIPS

This section will provide additional information on the basic principles of safety and fire protection for auto hobbyshops.

1. EYE PROTECTION

Recommend that attendants wear safety glasses. Ordinary corrective lenses are not approved safety glasses. See 1.7 for eye flushing instructions.

2. JEWELRY

Rings, metal watch bands, identification bracelets, or long chains should not be worn while working in and around the shop. Contact with the vehicle's electrical system can cause a short circuit, resulting in a shock or burn. Jewelry can also catch on objects, resulting in the loss of a finger or other injury.

3. CLOTHING

The wearing of long ties, scarves, and loose or torn clothing should be discouraged because such items can become caught in moving parts and cause serious injury.

4. CHECKING AND CHANGING OIL AND TRANSMISSION FLUID

Hoods should be unlocked with care and raised to a secure position. If the balance spring seems defective, it may be necessary to hold or block the hood open.

The oil-level gauge dipstick on some vehicles may be difficult to reach. Caution should be exercised to avoid burns from the exhaust manifold or to avoid cuts from sharp edges in the engine compartment or hood. Burns may also result if the dipstick comes in contact with exposed electrical terminals or wiring.

Check to be certain that the hood is locked to ensure that it will not fly open when the vehicle is in motion.

5. DRAIN PLUG REMOVAL

Removal of the crankcase, transmission, differential drain, and test plugs requires the proper tools. When the correct tool is placed on the plug or an adjustable wrench is fitted to the exact size required, force should be applied slowly. If an adjustable wrench is used, the force should always be applied against the fixed jaw of the wrench. If the plug is unusually tight, it can be loosened by holding the wrench on the plug with one hand and striking the wrench handle with the palm of the other hand. This exerts a force greater than can be achieved by pushing or pulling. It also eliminates the possibility of skinned knuckles or other injuries, which could occur if the wrench slips. Pipe wrenches and chisel should be used only as a last resort.

6. HIGH-PRESSURE LUBRICATION EQUIPMENT

Injuries from high-pressure, high-velocity grease gun equipment can be serious if not treated promptly and properly. If a high-pressure lubricating gun is discharged accidentally against some part of the body, the affected area should be examined immediately to see if petroleum products have penetrated the skin. These injuries cause little pain or bleeding but involve almost immediate separation of the skin tissues and possibly permanent deeper damage. It is essential that the injured receive immediate medical attention and that the attending physician knows the cause of the injury.

Because of the hazards involved, the starting mechanism of the lubricating gun should not be activated until the nozzle is set firmly against the fitting.

Should it be necessary to test the high-pressure lubrication equipment, place the open end of the nozzle into a metal waste container before operating the starting mechanism.

7. DISPOSAL OF WASTE OIL

Drainings should be disposed of promptly, either by letting them drain directly into a closed piping system that leads to an underground waste oil tank or by using a closed waste oil unit. If a bucket or pan is used, it should be emptied promptly into the underground tank or waste container. Since used crankcase oil sometimes contains traces of gasoline, thus creating a fire hazard, it should not be stored indoors in drums or other containers.

Waste oil or any flammable or combustible liquid must never be poured into sewers or septic tanks nor spread on the ground adjacent to the shop.

8. REMOVING WHEELS

Wheel bearing lubrication, tire changing, and other services may require removing wheels from the axles. When these operations are performed on a free-wheel or frame contact lift, the vehicle should be raised only a few inches from the floor. This permits the patron to remove or replace the wheel from a squatting position. This keeps the back in an upright position, minimizing the possibility of back strain. A vehicle on a drive-on lift should be blocked securely to prevent rolling. A jack can then be used to raise the wheels off the lift runners. Floor blocking can also be used. Just lower the lift sufficiently to free the wheels.

Compressed air should not be used for cleaning purposes or to blow residue from automotive brake systems. A safer method is to clean the parts with a liquid solution, allow the parts to air dry for a few minutes, then lubricate and assemble the parts.

9. LIFT OPERATION

Lifts should be checked regularly for air or oil leaks. The oil level should be checked and replaced as specified by the manufacturer. If a lift is equipped with automatic shocks, they should be lubricated regularly and kept in good operating condition. The stops on adapters of the frame contact hoist should be checked and any mechanical defects repaired or reported immediately. The safety leg or bar, if provided, must be maintained in good operating condition at all times. The deadman valve should be checked for proper operation.

When operating the lift, the safest procedure is to have the attendant position the vehicle on the lift. If a patron drives onto the lift, the attendant should act as a guide, but stand out of the path of the vehicle on the driver's side. People have been seriously injured when drivers inadvertently stepped on the accelerator or for some reason failed to stop when driving onto a lift.

Caution: Never stand in front of a vehicle being driven onto a rack, lift, or into a wash or lube bay.

Particular attention should be given to the proper alignment of the vehicle on a two-rail or frame-contact type of free-wheel lift. An off-center position might cause the vehicle to fall off the lift. When the vehicle is placed properly and all occupants are out of the vehicle, the following procedure is recommended:

- Place the transmission in the neutral position, turn off the ignition, close all car doors, and check obstructions (such as radio aerials), if clearance is limited.

- Place adapters in the proper position under both the front and rear axles or frame-contact points.

- Raise lift until the wheels are clear of the floor.

- Check again to ensure that the adapters are set accurately and that loads are not being placed on parts of the vehicle that might be damaged.

- Never block open the deadman valve.

- Never raise only one end of the vehicle with the lift. The vehicle could fall and roll.

- Always be aware of low obstructions when walking under a supported vehicle.

- The vehicle should not be worked on while it is being raised or lowered.

A vehicle on a drive-on type lift should be centered so that equal weight is distributed on each side of the lifting cylinder. The wheels should be chocked to prevent movement. If the lift is a drive-on, back-off type, a permanent block sufficient to stop a slow rolling vehicle should be affixed to the front end of the lift runners. As the lift is raised, the automatic chocks at the drive-on end of the lift runners should be observed for operability.

If it is necessary to enter the vehicle for any purpose, it should be lowered to the floor.

The lift should be controlled by a self-closing valve that must be held open by hand or foot.

Some lifts are equipped with a folding leg or with bars that fit through holes in the piston. The leg or bar acts as an emergency stop, preventing the accidental dropping of the lift. The lift can drop accidentally if the oil level in the supply tank is allowed to drop below a minimum level or if an attempt is made to operate the lift with continuous pressure, applied by blocking open the lift control valve. These unsafe conditions or practices should be corrected. Do not rely on the leg or the bar to fully support the vehicle. If at any time a lift equipped with such a device settles so that the leg or bar bears the weight of the lift and vehicle, the lift should be taken out of service until the condition causing the defect is corrected. The hydraulic lift may be equipped with a low-oil control valve, which will prevent operation of the lift when there is insufficient oil in the cylinder.

Some lubrication systems have a device on the lift that takes the weight off the springs or wheels, other devices rock the vehicle. When using such devices, be certain that the vehicle is not dislodged or overbalanced. On a free-wheel or drive-on type lift, the vehicle should never be raised so high that the axle is taken off the lift adapters or that the tires clear the chime of the lift runner.

Upon completion of work, the lift should not be lowered until persons, tools, and materials are cleared from beneath the lift. If the lift with the vehicle upon it has settled on the safety leg or bar, never knock out the leg or bar. Instead raise the lift until the safety leg or bar is completely free and can be removed.

When lowering the lift, the attendant should stand where he can see that all persons, equipment, and materials are in the clear. When the lift is not in use, it should be kept in the completely lowered position. If the floor around the lift is being cleaned, the lift should be elevated approximately two feet and access to it blocked.

10. AIR AND TIRE SERVICE

The many types of passenger car and truck tires and the specialized tire-changing equipment used today pose a wide variety of problems. Special training sessions are sometimes provided by the vendors and distributors of tires and service equipment. These training sessions should be attended and the literature presented studied.

11. INFLATING TIRES

An important hobbyshop function is to check and inflate tires. To inflate tires safely, the following precautions are suggested:

a. If a tire is in poor condition, do not inflate it; a blowout could occur.

b. Stand to one side when checking or inflating truck or automobile tires.

c. Keep your face above the fender or to one side when inflating tires.

d. When checking the spare tire, be certain that the trunk lid will remain up.

e. Tire pressure should be checked to prevent overinflation.

f. Guide the air hose back by hand on air pumps that have an automatic or weighted hose rewind. Do not let the hose fly back because the metal chuck or gauge may whip causing injury or damage. If the hose does not retract automatically, recoil and return the hose to the hanger.

12. TRUCK TIRES

The higher inflation pressures and the use of lock rings on truck tires require extra caution. Only trained and qualified personnel should be assigned this work. When inflating this type of tire, the lock rings should be checked to be sure they are seated properly. Work should not be done on a lock ring with pressure in the tire. Hands should be kept from between dual wheels while the tires are being inflated. If truck tires are removed for inflating or repair, a special cage fitted with bars to retain the lock ring should be provided to hold the wheel during inflation. Hands and legs should be kept out of the cage during inflation. When removing a truck tire, pressure should be released by removing the valve core before loosening the lock ring. The tire and lock ring should be reassembled properly. The principle cause of improperly seated lock rings is rust and dirt on the ring and wheel; these should be cleaned. Bent or damaged rings should not be used.

13. REPAIRING AND MOUNTING TIRES

The mounting of automobile and truck tires requires skill and knowledge. Safety procedures that are provided by the tire supplier or the manufacturer should be obtained and followed. The same precautions should be followed when checking, inflating, mounting, or repairing tires on vehicles such as tractors, motor scooters, motorcycles, or small trailers. Additional precautions, such as isolating ignition sources and providing adequate ventilation, need to be observed when repairing tires with certain patching compounds or liquids if the compounds are flammable or toxic. Tools used for tire repairs should be kept in good condition. Tires being repaired should not be left where they create a tripping hazard.

Tire-changing machines, if used improperly, may cause severe injury. Manufacturer's instructions for the safe operation of this equipment should be followed.

14. MOUNTING TIRE CHAINS

Safe mounting of tire chains requires adherence to the following precautions:

a. If the lift is used, the precautions discussed in item 9 (this section) should be observed.

b. If a jack is used, the front wheels should be chocked and the jack properly positioned. The keys should be placed on the dash, and no one should be permitted in the vehicle.

c. If it is necessary to work under the vehicle, safety jack stands should be placed under the vehicle's frame.

15. OTHER USES OF AIR

Compressed air for lubrication equipment or other customer services should be used carefully. A jet of air can cause injury if it strikes a wound or opening in the skin, or if it blows foreign matter into the eyes. Compressed air should never be used to blow dust or dirt from clothing. The air service hose should be used only for inflating tires and for certain lubrication and auxiliary services. Patrons should be prohibited from pressurizing fuel tanks, air horns, water tanks, or other pressure containers. Straight line pressure should be avoided except for emergency service. In such emergencies, only the hobby shop personnel should operate the equipment.

16. RADIATOR SERVICE

Most vehicles today have pressurized cooling systems, which require less frequent radiator checks. On many new cars only a visual check of the radiator reservoir tank is necessary. If a radiator must be checked, the following procedures are suggested:

- Allow the radiator to cool a minimum of 30 minutes before checking.
- Cover the radiator cap with a heavy material such as a tarp. (Do not use paper towels.)
- Stand back at arm's length.
- If the radiator cap does not have a pressure-relief lever, first tighten the cap and then loosen it to the first notch. If it is equipped with a pressure-relief lever, lift the lever into the open position.
- Remember that all pressure may not have escaped; the cap gasket may be stuck to the radiator neck.
- Finally, remove the cap, keeping the heavy material or tarp in position to deflect any steam or hot water that might escape.
- Once the cap has been removed, avoid positioning the face over the radiator. Coolant may erupt unexpectedly and violently.

If a patron asks to have his cooling system checked and there is evidence that the engine is at or near operating temperature, this can be accomplished by a visual check for external leakage. Any other cooling system maintenance should be performed by following the above procedures.

17. BATTERY SERVICE

Storage batteries contain an electrolyte solution of sulfuric acid that is corrosive and can cause painful burns or other injuries if it gets into the eyes, an open cut, or on the skin. Immediately after servicing a battery, the employee should wash his hands thoroughly. Until this has been done, hands should be kept away from the face and eyes. Battery solution will also corrode clothing, metal, and painted surfaces. Before servicing a battery, the corrosive particles that have accumulated around the terminals should be washed and brushed away. Cleaning should be done in a direction away from the body to prevent particles from getting into the eyes or onto clothing. Both the rubber tip of a hydrometer and the tip of a battery filling hose are pliable and may flip solution into the eyes. Be extremely careful when placing or removing the tips of these devices into or from battery openings.

a. Lifting and Removing Dead Batteries

The weight and position of a battery in a vehicle can sometimes create excessive strain problems when removing and replacing the unit. Be careful to prevent strains, sprains, or other injuries (see item 4 Health and Equipment Warnings).

To make lifting easier and to avoid touching the battery with the hands, a battery carrier should always be used. When the carrier has been placed on the battery, double check its grip to make sure it will not slip.

It is important to guard against short circuits when removing, installing, or handling batteries. To prevent short circuits, the ground cable should be disconnected last when installing the battery.

b. Charging Batteries

If a battery installed in a vehicle is to be given a quick charge, the vehicle should be moved away from flammables and the ground cable should be disconnected before connecting the charger. When using charger equipment without reverse polarity protectors, remove the ground cable to prevent alternator damage. If the battery is located under the floorboard, remove the battery before charging.

The manufacturer's instructions for loosening and removing the caps should be followed. During the charging process, periodically check to determine whether the battery is overheating.

Caution: Turn off the charger before disconnecting the cables from the battery. Failure to do so may cause a spark, igniting the hydrogen gas generated during the charge.

Caution: A frozen battery should never be "jumped" or charged.

c. Battery Jumper Cables

If jumper cables are hooked up incorrectly, expensive electrical systems could be damaged, and the chance of injury from an exploding battery increases. The following procedures should be used for negative-ground electric systems:

(1) Be sure that the stalled vehicle and the booster vehicle do not touch. If the two vehicles come together, a ground connection is established, which causes sparks and increases the danger of explosion when jumper cables are connected.

(2) Turn off all battery-operated accessories. Set the parking brake, and make sure that the transmission is in either neutral or park.

(3) Take off the vent caps from both batteries, check for adequate water in the batteries, and lay a cloth over the filler holes. This reduces the danger of explosion when a fully charged battery is connected to a fully discharged battery.

(4) For safety, follow this connection sequence:

1. Connect one jumper cable clamp to the positive terminal of the booster battery. Connect the other clamp of the same cable to the positive terminal of the discharged battery.
2. Connect one clamp of the second cable to the negative terminal of the booster battery. Connect the other clamp to a ground connection of the stalled vehicle more than 12 inches away from the filler openings on the dead battery.

Caution: Do not attach the negative jumper directly to the negative terminal of the dead battery. It could explode.

(5) After the stalled vehicle is started, remove the jumper cables in the reverse order of the previous steps, making sure to disconnect the ground connection first.

d. Handling Battery Solution

The battery solution should be handled only in areas that are well lighted and where an ample supply of water is available in case the solution is spilled. The following safety precautions are suggested:

- (1) Read and follow the instructions on the container.
- (2) Never squeeze or puncture a container with a screwdriver or other instrument; the solution may splash on face, hands or clothing.
- (3) Electrolyte solution spilled on the battery or in the filling area should be flushed immediately with water.
- (4) Never fill a new battery with electrolyte solution while in the vehicle. Fill the battery while it is on the floor, prior to installation.
- (5) Recap any electrolyte container that has not been emptied, and store it in a safe place at floor level. Never store electrolyte solution on shelves or other locations where the containers can overturn.
- (6) If the containers are to be returned to the manufacturer for refilling, they should be thoroughly rinsed with water. Otherwise, any solution remaining in the containers could be dangerous to persons unfamiliar with it. Containers of the nonreturnable type should be rinsed and cut open, thereby rendering them unfit for further use.
- (7) Baking soda (sodium bicarbonate) is an effective neutralizer for battery electrolyte solution. It should be sprinkled liberally on any spills and slightly wetted with water if necessary.
- (8) Cartons containing electrolyte solution should be stored in a location away from customer traffic. The ideal storage temperature ranges between 60-90 F.

4024. FAN BELTS

To prevent injury while installing or adjusting a fan belt, disconnect the battery or lock the ignition and remove the key to prevent starting the engine. Skinned knuckles can be avoided by placing a cloth between the hand and the radiator or by using gloves.

4025. SPARK PLUGS

The correct socket wrench for removing the plug should be selected. It should be tapped lightly to loosen the plug (not pushed or pulled) as cuts, bruises, or other injuries might result if the wrench should slip or if the plug comes free suddenly.

A sandblast plug cleaner should not be turned on until the plug is in the proper position. Be extremely careful when cleaning the spark plugs with the abrasive blast. Place the spark plug in the rubber cleaner adapter of the correct size. During this operation stand at arm's length and wear goggles to prevent eye injury.

Compressed air at a pressure no greater than 30 pounds per square inch gauge can be used to clean spark plugs if goggles are worn.

4026. DRIVING CUSTOMERS' VEHICLES

Only an employee with a valid driver's license should be authorized to drive a customer's vehicle.

Check the vehicle's brakes immediately. Vehicles with faulty brakes should not be operated.

4027. PRIMING CARBURETORS

Do not attempt to start a stalled vehicle by pouring fuel into the carburetor while the engine is being turned over with the starter. A flashback can ignite the fuel vapors. With the engine stopped, pour a small amount of fuel or other starter liquid into the carburetor air intake, then replace the air cleaner and lower the hood. The attendant should stand back while an attempt is made to start the engine. This procedure may be repeated as often as necessary to start the engine.

4028. RECEIVING AND STORING MERCHANDISE

When receiving and storing merchandise, such as drums of grease, cases of oil, tires, batteries, and accessories, the following safety precautions should be observed:

1. Store the merchandise in a neat and orderly manner where it will not fall if disturbed.

2. Store heavy items on lower shelves.

3. Do not store combustible material, such as maps, station forms, work clothes, and so forth, near a heater unit or on heating ducts.

4. Arrange indoor and outdoor promotional displays so that they will not be a hazard to customers.

4029. NO SMOKING OR OPEN FLAMES

Driveway areas of auto craft shops that are used for fueling motor vehicles, dispensing flammables, antifreeze, or receiving products, should be free of open flames, the "No Smoking-Shut Off Engine" rule should be observed by everyone in the area. The sections of the building used for servicing vehicles or other kinds of internal combustion engines should have "No Smoking" signs.

4030. ANTIFREEZE

Many of the permanent type antifreezes are not flammable; however, alcohol type solutions are flammable and may give off vapors, which can be ignited. Reading the container label is important to determine the flammability of the liquid. If a flammable-type antifreeze is spilled on the engine, the antifreeze should be cleaned thoroughly from the engine before it is started. Alcohol-type antifreeze solution should be drained in adequately ventilated areas away from ignition sources, and the drainings handled like other flammable liquids.

Leaks may release flammable liquids, creating a fire hazard. The vehicle's cooling systems and water heaters should be checked for leaks. To provide maximum protection for the customer, the radiator hose should be inspected thoroughly and replaced, if necessary, before the radiator is filled with a flammable antifreeze mixture.

Containers with drainings should not be stored indoors and should be emptied promptly. Since the drainings are water soluble, they can be washed away with clear water.

Only ethylene glycol based antifreeze or other non-flammable antifreeze should be sold in the retail activity.

4031. COMPRESSED GAS FOR WELDING, CUTTING, AND BRAZING

Gas cylinders should not be dropped or otherwise roughly handled.

No one in the craft shop should use the oxygen-fuel gas equipment unless they have been properly instructed. Never permit a patron or unauthorized person to use this equipment.

In cylinder storage areas, there should be a sign posted reading, "Danger - No Smoking, Matches or Open Flame."

Oxygen cylinders should not be stored near highly combustible material, especially oil and grease.

Cylinder, cylinder valves, couplings, regulators, hose, and apparatus should be kept free from oily or greasy substances. Oxygen cylinders or apparatus must not be handled with oily hands or gloves. A jet of oxygen must never strike an oily surface, greasy clothes, or enter a fuel, oil, or other combustible or flammable material storage tank.

Oxygen and fuel cylinders should be secured in an upright position by means of a chain or bar. Oxygen and fuel cylinders in storage should be separated by a minimum of 20 feet or by a 5-foot high noncombustible wall. Valve caps should be replaced on all cylinders not in service.

Be sure that all cylinder valves are closed before moving them, when work is finished, or when the cylinder is empty.

Never use oxygen as a substitute for compressed air.

Before each use, be sure that the oxygen-fuel gas hoses do not have any leaks, burns, worn places, or other defects.

Cylinder valves should be opened slowly. Do not stand in front of glass covered gauge faces.

All empty cylinders should be marked "Empty" or "MT." They should be separated from the full cylinders and promptly returned to the supplier with the valve-protection caps in place. All valves must be closed.

No person, other than the gas supplier, should attempt to mix gases in a cylinder. No one, except the gas supplier, should refill a cylinder.

Cylinder valves should not be tampered with nor should any attempt be made to repair them. If you experience trouble, the supplier should be notified promptly, indicating the type of the trouble and the cylinder's serial number. The supplier's instructions as to its disposition must be followed.

4032. ELECTRIC ARC WELDING

Employees who operate resistance welding equipment should be properly instructed and judged competent before being allowed to operate the equipment.

If the welding machine becomes wet, be sure it is thoroughly dried and tested before using again.

Check the welding area to ensure that the atmosphere is free of mixtures of flammable gases, vapors, or liquids. If there is the possibility of an explosive atmosphere, do not start welding. Do not weld or burn on gasoline or other fuel tanks until they are certified free of flammable mixtures.

At least one 10BC fire extinguisher should be provided. Check the connections to the machine to be sure they are properly made. Coiled welding cable should be spread out to prevent damage and overheating of the cable insulation. The work or ground lead must be firmly attached to the work before starting to weld.

Ground and electrode cables must be joined together only by a connector specifically designed and insulated for this purpose

If any of the cables have splices within 10 feet of the operator, they should not be used. The operator should not coil or loop the cables around any part of his body.

Helmets or hand shields must be used when arc welding. The helmet should be made of material that insulates against heat and electricity. It should protect the head, face, neck, and ears from direct radiant energy. Anyone assisting the operator or standing close to the arc welding should wear adequate eye protection.

Fire-resistant curtains or suitable shields should be set up around the craft shop.

Inform employees who do arc welding to wear woolen or other clothing made from fire-resistant fabrics, to keep clothing free from grease and oil, and to keep sleeves and collars buttoned. Gloves should be worn while welding.

Any material that might be hot should be identified by a sign or by marking the work itself with soapstone.

Electrode holders not being used should be placed so that electrical contact cannot be made with personnel, conducting objects, fuel, or compressed gas tanks. They should be disconnected from the power source.

4033. BENCH OR PEDESTAL GRINDERS

The following precautions are recommended when using bench or pedestal grinders:

1. Abrasive wheels should be used only on machines equipped with safety guards. Check that the safety guard covers the

spindle, end nut, and flange projections. The exposed front and sides of the grinding wheel should not exceed more than one-fourth of the entire wheel. When measuring the guard opening, do not include the visors or other accessory equipment as a part of the guard unless this accessory equipment is as strong as the guard.

2. Work or tool rests should be of strong construction and designed to be adjustable to compensate for wheel wear. Work rests should be closely adjusted to the wheel, with a maximum clearance of 1/8 inch. This 1/8 inch clearance or less will prevent the work from becoming jammed between the wheel and the work rest.

3. If an operator stands in front of the opening, the safety guard should be constructed so that the tongue guard can be adjusted to the constantly decreasing diameter of the wheel.

4. All abrasive wheels should be mounted between flanges. These flanges should not be less than one-third the diameter of the entire wheel. Some exceptions are:

- a. Mounted wheels.
- b. Portable wheels with threaded inserts or projecting studs.
- c. Abrasive disks (inserted nut, inserted washer, and projecting stud type).
- d. Cylinders, cups, or segmented wheels mounted in chucks.
- e. Types 27 and 28 wheels.
- f. Modified Types 6 and 7 wheels.
- g. Cutting of wheels, Types 1 and 27A. Regardless of the flange type you use, be sure the wheel is always guarded.

5. Blotters (compressible washers) should always be used between the flanges and abrasive wheel surfaces. Use of the blotters uniformly distributes flange pressure.

6. The driving flange should be securely attached to the spindle and the bearing surface should run true.

7. Carefully inspect and sound test (ring test) all wheels immediately before mounting to ensure that the wheel hasn't been

damaged in transit or storage. Ring test procedure: Tap the wheel lightly with a nonmetallic object, such as screwdriver handle. If the wheel sounds cracked (dead), it should not be used.

8. The grinding wheel arbor should be of a size to fit freely on the spindle and to remain free during all grinding conditions.

9. When a bushing is used in the wheel hole, it must not exceed the width of the wheel and must not contact the flanges.

10. After mounting a wheel, check that the safety guard is replaced and the work rest and tongue guard are properly adjusted before starting the wheel.

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APPENDIX A

PLANNING FORMAT

STARTING A BASIC AUTOMOTIVE CLASS

Goal Statement: To improve the educational activities at the Auto Hobbyshop

Objective: Conduct a Basic Automotive Class

ACTION STEPS	WHO	BEGIN	END
1. Set up class syllabus	John	Oct 1	Oct 5
2. Set up instructor for class	John	Oct 5	Oct 10
3. Set up space for class	Joan	Oct 5	Oct 10
4. Advertise Class in:			
a. Newspaper	Pete	Oct 10	Oct 30
b. Fliers	Jerry	Oct 10	Oct 30
c. Posters in other activities	Jerry	Oct 10	Oct 30
d. Other	John	Oct 10	Oct 30
5. Order supplies for class	Ron	Oct 15	Oct 30
6. Take registrations	John	Oct 21	Nov 1
7. Set up demonstration car	Ron	Oct 25	Oct 25
8. Make up class certificate	Jerry	Oct 27	Oct 30
9. Conduct class	John	Nov 4	Dec 4
10. Pay instructor	Harry	Dec 5	Dec 10

Supplies - spark plugs, paper course book, certificates

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APPENDIX B

EQUIPMENT LIST

(12 Stall Auto Hobbyshop)

1. Equipment Items Required to Equip Shop

4	ea	Bench Grinder
4	ea	Bench Buffer
3	ea	Spark Plug Cleaner-Tester
12	ea	Steel Work Benches
2	ea	2-Station Welding Table
2	ea	Hydraulic Lift/Electric Lifts Above & Below Deck
4	ea	Bumper Jacks
1	ea	Tire Changer & Tire Repair Tools
1	ea	Brake Lathe
1	ea	Armature Lathe
1	ea	Arbor Press
2	ea	Vacuum Cleaner
1	ea	Vacuum Fuel Pump Tester
2	ea	Tachometer Volt-Ohm Meter
2	ea	Micrometer
1	ea	Headlight Adjuster
6	ea	Machinist Vise
2	ea	Blacksmith Anvil
1	ea	Air Compressor System with Outlets @ Each Bay w/ 5 HP, 3 Phase Compressor
1	ea	Spray Booth & Guns
1	ea	Scope Analyzer & Exhaust Test Unit
1	ea	Welding Unit (Electric & Acetylene)
2	ea	Portable Crane
1	ea	Valve Refacer
1	ea	Steam Cleaner
1	ea	Transmission/Differential Lift
4	ea	Motor Repair Stand
4	ea	Parts Cabinet
1	ea	Wheel Balancer (Dynamic)
1	ea	Parts Cleaning Machine
1	ea	Alignment Service (Machine & Lift)

2. Equipment Required to Equip Stalls

12 Sets (8 stan- dard, 4 metric)	Mechanics Tool Set consists of 1 combination wrench set, 5" adjustable wrench, 10" adjustable wrench, 1/4" drive socket set, 3/8" drive socket set, 6 plastic handle screwdrivers, offset screwdriver, diagonal cutting pliers, needle nose pliers, wrench pliers, slip joint pliers, carbon scraper, 2 feeder gauge sets, hacksaw, rolling head bar, set of 4 punches, 1 chisel
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4	ea	Jack, 2 ton
1	ea	Jack, 4 ton
12	pr	Jack Stands, 5 ton
12	ea	Drop Cords "Cordomatic," 30'
12	ea	Air Hose
12	ea	Air Hose Nozzle
12	ea	Air Hose couplers, swivel type
12	ea	Creepers
12	ea	Tray, metal
12	ea	Trash Cans, metal
12	ea	Work Lights

3. General Items of Equipment and Tools Required for Normal Repairs and Operations

1	set	Puller, Light Duty (Mechanical)
1	set	Puller, Heavy Duty (Hydraulic)
1	ea	Puller, Steering wheel
3	sets	Tools, Brakes adjusting
1	set	Ignition Feeler Gauge
1	set	Brake Feeler Gauge
3	sets	Standard Feeler Gauge
1	set	Ring Compressor
1	set	Valve Guide Cleaner
1	set	Gasket Scraper
1	set	Carbon Scraper
2	sets	Allyn Wrenches
1	set	Automatic Transmission, band adjusting set & panel set
3	ea	Wrench, Torque
1	set	Wrench, Offset
1	ea	Hammer, Rubber
1	ea	Hammer, Plastic
1	ea	Hammer, Brass
1	ea	Hammer, Metal & Rubber
2	sets	Pliers, Brake spring
2	sets	Screw and Pipe extractor "easy out"
1	ea	Wrench, Distributor
2	sets	Drill Bit set, high speed, metal
1	ea	Lathe, Armature, for Mica Cutting & Commutator Cutting
2	ea	Soldering Iron, w/tips
1	ea	Jack, Transmission Universal
1	ea	Hoist, Engine, 1 ton
1	ea	Radiator Cap Tester & Radiator Leak Tester
1	ea	Air Cleaner Tester (Tests Air Filters for Holes)
1	ea	Ridge Reamer
1	set	Deglazing Hones
1	set	Brake Cylinder Hones
2	ea	Air Wrench 1/2" w/socket sets

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2	ea	Air Chisel w/chisels
2	ea	Air Drill w/bits
2	ea	Air Wrench 3/8", Midgets set w/sockets & Angle Head
2	ea	Air Buffer
1	ea	Valve Spring Compressor Universal
1	set	Jaws for Above
1	ea	Valve Keeper Insert
1	ea	Valve Spring Lifter
3	ea	Hand Valve Grinders
2	ea	Distributor, Carburetor, Adjustment Tool
2	ea	Ignition Universal Point Aligning Tool
2	ea	Automotive Charger 80/40 amps
2	ea	Air Gauges
1	set	Tap & Die Set
1	ea	Axle Threader
6	ea	Wire Brush
2	ea	All Position Mirror, square
1	ea	Mechanic's Stethoscope
2	ea	Remote Starter Switch
1	set	Thickness Gauges
1	ea	Flaring Tool for Brass Tubing
1	ea	Brass Tubing Cutter
1	ea	Muffler & Tail Pipe Cutter
1	ea	Tire Test Tank
4	ea	Radiator Filler Can

4. Items Required for Lubrication Work

1	ea	Grease Pump, High Pressure Air Operated
1	ea	Automatic Transmission Filler
1	ea	Drain Receptacle
4	ea	Grease Gun
1	ea	Oil Gun, Hand Operated
1	ea	Water Pump Adapter
1	ea	Universal Joint Adapter
1	ea	Measuring Cans, 5 qt
8	ea	Drain Pans

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APPENDIX C

SAFETY CHECKLIST

<u>WALKING AND WORKING SURFACES, AISLES AND FLOORS</u>	YES	NO
Are all areas of the shop kept clean and orderly?	_____	_____
Are floors, aisles and passageways kept clean and dry and all spills of oil or grease cleaned up immediately?	_____	_____
Are floor holes, such as drains, covered?	_____	_____
Are permanent aisles appropriately marked?	_____	_____
Are all working surfaces, such as aisles and service bays, free from clutter or obstructions?	_____	_____
<u>STORAGE LOFTS, SECOND FLOORS, ETC.</u>		
Are signs showing floor-load capacity present?	_____	_____
Are racks and platforms always loaded within the limits of their capacity?	_____	_____
Are storage lofts, balconies, etc., that are more than 4 feet above the floor protected with standard guardrails?	_____	_____
Are all lofts and balconies where people or machinery could be exposed to falling objects guarded with standard 4 inch toeboards?	_____	_____
Is the safety leg or hoist safety pin always positioned when using lifts?	_____	_____
When using a lift, is vehicle checked for proper positioning just after wheels have left the floor?	_____	_____
Are there standard stair rails (34") on all stairways of more than 4 stairs?	_____	_____
Are there standard stair rails (34") on all stairways having open sides?	_____	_____
Are all stairways at least 22 inches wide?	_____	_____
Do stairs have at least a 7-foot overhead clearance?	_____	_____

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Are stairs and rack surfaces maintained free of tripping and slipping hazards? _____

LADDERS

Have defective ladders (e.g. broken rungs, side rails, etc.) been removed from service for repair or destruction and tagged as "Dangerous Do Not Use"? _____

Is it prohibited to use the top of an ordinary step ladder as a step? _____

Do fixed ladders have at least 3 1/2 feet extensions at the top of the landing? _____

Do portable rung ladders have non-slip bases? _____

Is the distance between the centerline of rungs on a fixed ladder and the nearest permanent object in back of the ladder at least 7"? _____

Do all fixed ladders have a preferred angle of 75 - 90 degrees? _____

EGRESS

Are all exits marked with an exit sign and illuminated by a reliable light source? _____

Is the lettering at least 6 inches high with the principal letter strokes at least 3/4" wide? _____

Is the direction of exits, when not immediately apparent, marked with visible signs? _____

Are doors or other passageways, that are either not access to an exit, or located where they may be mistaken for exits, appropriately marked "Not An Exit", "To Basement", "Storeroom", etc.? _____

Are exit doors side-hinged? _____

Are all doors that must be passed through to reach an exit always free to access with no possibility of a person being locked inside? _____

Are all exits always kept free of obstructions? _____

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OCCUPATIONAL HEALTH AND ENVIRONMENTAL CONTROL

Are the tail-pipe exhaust systems in good working order (not plugged, no broken hoses, etc.)? _____

Are engines turned off except when using the tail pipe exhaust system? _____

Are the gas space heaters properly vented? _____

Are employees properly protected during dusty and noisy work processes? _____

Is dust vacuumed whenever possible, rather than blown or swept? _____

Are solvent soaked, greasy, or oily rags and combustible materials disposed of in covered metal containers and emptied daily? _____

HAZARDOUS MATERIALS, FLAMMABLE AND COMBUSTIBLE LIQUIDS

Is paint stored in approved metal or wood cabinets or storage rooms? _____

Do storage rooms have explosion proof lights? _____

Is non-flammable solvent used in the parts cleaner? _____

SANITATION

Are rest rooms and washrooms kept in clean and sanitary condition? _____

Are covered receptacles provided in the women's rest room for sanitary napkins? _____

MEDICAL AND FIRST AID

Is at least one employee on each shift currently qualified to render cardiopulmonary resuscitation and first aid? (Some states require first aid trained persons regardless of nearby clinics or hospitals.) _____

Are approved first aid supplies readily available, inspected and replenished? _____

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FIRE PROTECTION

Are extinguishers selected for type of materials in areas where they are to be used? _____

Class A. Ordinary combustibile-material fires _____

Class B. Flammable liquid, gas or grease fires _____

Class C. Energized electrical-equipment fires _____

Are extinguishers fully charged and mounted in designated places? _____

Are extinguishers located along normal paths of travel? _____

Are extinguishers free from obstruction or blockage? _____

Are extinguishers not mounted too high? If less than 40 lbs., the top must be below 5 ft. above floor - greater than 40 lbs., the top must be below 3 1/2 ft. above floor. _____

Have all extinguishers been serviced, maintained, and tagged at intervals not to exceed 1 year? _____

Are all extinguishers checked (by management or designated employee) monthly to see if they are in place or if they have been activated, etc.? _____

Have all extinguishers been hydrostatically tested according to schedules set for the type of extinguisher? _____

COMPRESSED AIR EQUIPMENT

Is compressed air, which is used for cleaning, reduced to 30 psi when dead ended? (Can be accomplished by using special nozzles or air pressure reducing valves.) _____

Are compressed air tanks drained regularly? _____

Do the relief valves operate properly? _____

MACHINE AND MACHINE GUARDING

Are all points of power transmission properly guarded; e.g. belts and pulleys in motors, compressors, rotating shafts, sprockets and gears, etc.? _____

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Are all pieces of equipment with an electric motor or any electrical connection effectively grounded?

Are all fan blades 7 feet or less from the floor guarded in such a manner that there exist no openings greater than 1/2 inch?

Is all fixed machinery securely anchored to prevent movement?

Are sprockets and V-belt drives within reach of platforms and passageways or less than 7 feet from the floor completely enclosed?

Is the adjustable tool rest on top side of grinder used and kept adjusted to within 1/4" of wheel?

Are spindle guards being used?

Are bench and pedestal grinders permanently mounted?

Are goggles or face shields always worn when grinding?

HAND AND PORTABLE POWER TOOLS

Have chisels or punches with mushroom heads been replaced?

Have broken hammer handles been replaced?

Have worn or bent wrenches been replaced?

Have deteriorated air hoses been replaced?

Are portable abrasive wheels appropriately guarded; e.g. right angle grinders?

JACKS

Are jacks checked periodically to see if they are in good condition?

Are cars on jacks cribbed, blocked, or secured at once?

Are support stands always used after the vehicle has been raised with a hydraulic jack?

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WELDING, CUTTING, BRAZING

Are cylinders stored away from heat?	_____	_____
Are stored gas cylinders and oxygen cylinders separated by 20 feet or a barrier 5 feet high?	_____	_____
Are cylinders secured and stored where they cannot be knocked over?	_____	_____
Are cylinder protective caps in place when not in use?	_____	_____
Are the valves shut off when not in use?	_____	_____
Are flash shields provided to protect nearby workers from the welding flash?	_____	_____
Is ventilation adequate or are respirators provided when welding or cutting in confined spaces?	_____	_____
Is welding always conducted at a safe distance from flammable liquids?	_____	_____

LIFTS

Do employees stand to one side of vehicles when directing them into position over the lift?	_____	_____
Are hoist controls manually operated and not blocked into the open or shut position?	_____	_____
Are loads squarely engaged, and neither the lift nor adapter overloaded?	_____	_____
If a lift is equipped with a mechanical locking device, do employees check that the device is in place when the lift is up?	_____	_____
When a lift malfunctions, do you make certain it is removed from service and repaired immediately?	_____	_____
Are employees instructed to make certain that grates over floor drains are large enough to cover the floor drain opening and are securely in place?	_____	_____

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TIRE REPAIR

Is a safety rack, cage, or equivalent protection provided when inflating, mounting, or dismounting tires installed on split rims or rims equipped with locking rims or similar devices (particularly truck tires)?

BATTERY CHARGING

Hydrogen is emitted during battery charging and must be vented to prevent explosions in the presence of a spark. Are "NO SMOKING" signs posted in this area?

NATIONAL ELECTRICAL CODE ELECTRICAL WIRING

Is electrical equipment accessible, in good repair, and approved for the location?

Have exposed wires, frayed cords, and deteriorated insulation been repaired or replaced?

Are junction boxes, outlets, switches, etc. covered?

Are breaker switches identified as to their use?

GROUNDING

Is all metal, fixed equipment grounded?

Does all equipment connected by cord and plug have grounded connections?

Are appliances such as vacuums, polishers, vending machines, etc. grounded?

Do all extension cords being used have a ground wire?

Are all plugs equipped with ground pins?

FLEXIBLE CORDS AND CABLES

Are flexible cords and cables not run through holes in wall or ceiling?

Are flexible cords and cables free from splices or tape?

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Are flexible cords and cables fastened so that there is no direct pull on joints or terminal screws?

Are flexible cords and cables never substituted for fixed wiring?

Are flexible cords and cables not attached to building surfaces?

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